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PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant:	Harold Rosen et al.	Date:	June 2, 2003
Serial No:	09/963,619	Group Art Unit:	3727
Filed:	September 25, 2001	Examiner:	Steven M. Pollard
Title:	LIGHT WEIGHT HYDROGEN TANK		

BRIEF ON APPEAL

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Date: June 2, 2003

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The following Appeal Brief is submitted pursuant to the Notice of Appeal filed on April 3, 2003. The Brief is being filed in triplicate in compliance with 37 CFR 1.192(c).

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The Commissioner is authorized to charge necessary fees due to Deposit Account No. 50-0383.

I. Real Party in Interest

The real party in interest in this matter is Hughes Electronics Corporation in El Segundo, California ("hereinafter "Hughes" or the "Applicant").

II. Related Appeals and Interferences

There are no other known appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in the pending appeal.

III. Status of the Claims

Claims 12, 14-30 and 32-39 are currently pending in the case.

Claims 12, 14-20, 23-30 and 32-39 stand rejected in the Final Office Action.

Claims 21 and 22 are objected to as being dependent upon a rejected base claim, but were indicated as being allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

A copy of all of the currently pending claims is attached as an Appendix.

IV. Status of Amendments Filed After Final

There have been no amendments filed subsequent to the Final Office Action mailed January 23, 2003.

V. Summary of the Invention

The present invention relates to hydrogen fuel tanks and more particularly to stratospheric vehicles utilizing such fuel tanks. A substantial need exists for

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lightweight fuel tanks designed to store hydrogen fuel in stratospheric vehicles which are used for the nation's ever growing communication systems. Stratospheric vehicles are used as platforms for communication repeaters which provide a variety of communication services. Hydrogen powered stratospheric vehicles are considered to be one of the best vehicles for these services. The high density of hydrogen can achieve the long endurance at high altitudes needed for commercial communication systems. Hydrogen, when combined with oxygen, can yield three times the energy density of gasoline. Also, stratospheric vehicles fueled by hydrogen can stay aloft for weeks at a time.

Known hydrogen fuel tanks are extremely heavy and have several disadvantages which make them difficult to utilize for stratospheric vehicles. In conventional designs, the weight necessary to withstand the internal pressures and provide the appropriate insulation, offset most of the endurance improvements that the energy density of hydrogen provides.

With the present invention, as illustrated for example in Fig. 2 and described on pages 3-6, an inner spherical shell (12), preferably made of a metal material is provided which is surrounded by a concentric metal and/or composite outer shell (14). (See for example page 3, lines 13-22.) The two shells are separated by a radial insulating gap (40), which is evacuated to a high vacuum. (See for example, page 4, lines 5-7, and page 5, lines 19-23.) The outer shell preferably has a sandwich structure, with a pair of skins having a core of a low conductive material. (See for example, page 3, lines 24-26 and page 4, lines 9-19.) Also, the mutually facing

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

surfaces of the inner and outer shells (30, 32) are coated with a low emissivity metal, such as copper or silver. (See for example, page 5, lines12-18.) The vacuum gap and low emittance surface finishes on the two shells provide appropriate thermal insulation eliminating the necessity for heavy, thick layers of insulation.

A heating member (50) conducts a controlled amount of heat to the outer shell and controls the rate of evaporation of the material contained in the inner shell member. It is important to control the evaporation rate of the hydrogen in order to retain the maximum during duration of the vehicle's flight. The heater (50) controls the evaporation rate of the hydrogen in the tank to match the fuel usage demand during operation. (See for example page 5, lines 24-26 and page 6, lines 1-4.) A second electrical heater (60) can also be placed on the outer shell to prevent icing of the fuel tank during ascent and descent of the stratospheric vehicle. (See for example, page 6, lines 5-10.)

With the applicant's invention, a smaller, lightweight and less expensive hydrogen fuel tank for stratospheric vehicles is provided. The present invention satisfies the need that exists in the field for stratospheric vehicles and thus allows greater use of platforms for communication repeaters and a greater variety of communication services to the public.

Three independent claims exist in the case (claims 12, 18 and 30), each of which have a series of dependent claims associated with it. Independent claim 12 covers the lightweight fuel tank (10) itself, the tank having inner and outer spherical shell members (12, 14), the inner spherical shell member (12) positioned inside the

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

outer shell member (14), the inner shell member (12) and the outer shell member (14) being positioned to provide an insulating radial gap (40) between them, a first port member (27, Figs. 2 and 3) for evacuation of the radial gap to a vacuum between the shell members, and for filling the inner shell with hydrogen material, a first heating mechanism (50) for controlling the rate of evaporation of the material contained in the inner shell member, and the two facing surfaces of the inner and outer shell members (30, 32) in the radial gap being coated with a low emissivity material.

Claims dependent from claim 12 call for a second heating mechanism (60) on the outer shell member (14) for controlling icing (claim 14), the outer shell member (14) having a sandwich construction employing low heat conducting skin and core materials (claim 15), the low emissivity material on the inner and outer shell members being a flash of copper (claim 16) and a second port member (20) in the inner shell member having a valve mechanism (13, Figs. 2 and 3) (claim 17).

Independent claim 18 calls for a stratospheric vehicle having the fuel tank with inner (12) and outer spherical shell members, the inner spherical shell member positioned inside the outer spherical shell member, the inner and outer shell members having an insulating radial gap between them, the inner shell member (12) having its outer surface (30) coated with a low emissivity material, and the outer shell member (14) having a sandwich construction with a lightweight metal inner skin member (15), a lightweight composite outer skin member (17), and a core member made from a low thermal conduction insulated material. The claims dependent from claim 18 further add to the subject matter a heating mechanism for controlling the rate of evaporation

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

of the material in the inner shell member (claim 19), a second heating mechanism on the outer shell member for controlling icing of the fuel tank (claim 20), the low emissivity material being a flash of copper (claim 23), the inner skin member being coated with a low emissivity material (claim 24), said low emissivity material being copper (claim 25), a first port member in the outer shell member (claim 26), a second port member in the inner shell member (claim 27), the inner and outer shell members being connected at only three locations (claim 28), and the inner and outer shell members being connected by a friction welding insert member (33) (claim 29).

Independent claim 30 is also directed to a lightweight fuel tank having concentric inner and outer spherical shell members with an insulating radial gap, together with two heating mechanisms on the outer shell member, one for controlling the rate of evaporation of material in the inner shell member, and the other for controlling icing of the fuel tank during use.

The dependent claims which are dependent from independent claim 30 add to the subject matter of claim 30 the following features: a port member in the outer shell member (claim 32), a second port member in the outer shell member (claim 33), a low emissivity coating on the outer surface of the inner shell member (claim 34), a low emissivity coating on the inner surface of the outer shell member (claim 35), such low emissivity material being a flash of copper (claims 36 and 37), the outer shell member having a sandwiched construction employing a low heat conducting skin and core materials (claim 38), and the outer shell member having a sandwiched construction

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

with a lightweight metal inner skin member, a lightweight composite outer skin member, and a low thermal conduction insulation core member (claim 39).

VI. Issues

The following issues are presented in this appeal, the issues corresponding directly to the Examiner's final grounds for rejection and the final Office Action dated January 23, 2003:

(a) Whether claims 12, 14-17, 30, and 32-37 are unpatentable under 35 U.S.C. §103(a) as being obvious over the Strong et al. patent (U.S. No. 2,776,776), in view of the Ishizaki et al. patent (U.S. No. 4,856,174), the Beckman patent (U.S. No. 3,147,877), and the Androulakis patent (U.S. No. 4,140,073).

(b) Whether claims 18-20, 23-29, 38 and 39 are obvious and thus unpatentable under 35 U.S.C. §103(a) over the same combination of references as set forth in (a) and further in light of the teachings of the Cherevatsky patent (U.S. No. 6,145,692).

VII. Grouping of Claims

The rejected claims can be considered in the following groupings:

(1) Claims 12 and 14-17;

(2) Claims 18-20 and 23-29; and

(3) Claims 30 and 32-37.

VIII. Argument

A. The Correct Legal Analysis for Determining Obviousness

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed inventions where there is some teaching, suggestion, or motivation to do so, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.3d 1071, 5 U.S.P.Q.2d 1597 (Fed. Cir. 1988). The mere fact that references can normally be combined or modified does not render the resultant combinations obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). Additionally, it is improper to combine references where the references teach away from their combination. In re Grasselli, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983).

Under the obviousness standards in the Patent Statute (35 U.S.C. §103), the scope and content of the prior art is to be determined, the differences between the prior art and the claims are to be ascertained, and the level of ordinary skill in the art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unresolved needs, failure of others, etc. are relevant to the obviousness issue. Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 U.S.P.Q. 459 (1966). Also, where secondary considerations exist, they must be considered and taken into account. In re Sernaker, 702 F.2d 989, 996, 217 U.S.P.Q. 1 (Fed. Cir. 1983). In fact, secondary considerations are often the most "probative," "cogent" and objective evidence in

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

existence and point strongly to a finding of unobviousness. Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1538, 218 U.S.P.Q. 871 (Fed. Cir. 1983).

Once an invention is disclosed or understood, it is very easy for persons to analyze it and assert that it would have been obvious. However, that is not the test. It is totally improper and erroneous to use hindsight in construing the obviousness of an invention. In re Dembiczak, 175 F.3d 994, 999, 50 USPQ 1614, 1617 (Fed. Cir. 1999).

Finally, any combination of prior art references must reach all of the claim limitations in order to establish a prima facie case of obviousness. MPEP §2143.

B. Claims 12 and 14-17 Are Not Obvious

On the merits, claims 12 and 14-17 stand rejected under 35 U.S.C. §103 as being obvious and thus unpatentable over a combination of four different references, namely the Strong et al., Ishizaki et al., Beckman, and Androulakis patents. The Examiner indicates that it would have been obvious to one of ordinary skill in the art to have employed the low emissivity coated surface teaching set forth in Ishizaki et al., motivated by the insulated properties achieved thereby, the multiple port teaching set forth in Beckman, motivated by the evacuation option achieved thereby, and the outer heating mechanism in view of the cooling teaching set forth in Androulakis, motivated by the intended use, all in the construction of the device set forth in Strong et al. Thus, as to independent claim 12, the Examiner has strung together various features from four independent references alleging, without any support, that persons or ordinary skill in the art would be "motivated" to combine them in the manner set

forth in the claim – even though the Examiner's combination does not teach all of the elements of the claim. It is submitted that such rejection clearly uses the benefit of hindsight based on the Applicant's teaching and claimed subject matter. Under the appropriate legal authorities, this is improper.

In order to combine the four prior art references, all of the claim limitations must be disclosed in at least one of the references in order to establish a prima facie case of obviousness. This is not the situation with these four references, however, since they do not teach all of the various features and elements of claim 12, or for the reasons that they are included in the inventive subject matter. For example, Androulakis teaches cooling and not heating, and the references teach liquid fuel storage tanks with thick, heavy walls or structures.

The Strong et al. patent discloses an insulated container for storing cold liquified gases and discloses the use of thick and heavy insulation material positioned between the double walls of the tank member. The Ishizaki et al. patent merely teaches a stainless steel vacuum bottle, the surfaces of the walls having silver mirrored layers thereon. The Androulakis patent merely teaches a thermal barrier system for a liquified gas tank. As opposed to the use of heating mechanisms on the outer shell for various purposes, Androulakis instead utilizes shields or thermal barriers on the external surface and does not disclose heating in any manner. Finally, the Beckman patent merely teaches various tank devices for storing liquified gases and does not disclose any of the other key aspects of the Applicants' invention.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

Also, none of the four references, nor any combination of them, address the problem confronted and solved by the Applicants, let alone suggest the Applicants' solution to it. The need for a long endurance, lightweight hydrogen fuel tank for stratospheric vehicles has existed for some time and prior to the Applicants' invention, has not been achieved.

The Examiner had to combine the features of four separate references together in order to make the §103 obvious rejection as to claim 12, as well as claims 14-17 dependent therefrom. This points to the conclusion that the Applicant's solution to the stratospheric fuel problem was indeed unobvious. If indeed the invention was obvious, then it would have been previously referenced, disclosed, mentioned, or alluded to in some manner in the art. The fact that none of these references disclosed or suggested the combination of features forming claims 12 and 14-17 emphasize the unobviousness of the claimed invention. There is no motivation disclosed or suggested in any of the references to combine them in the manner stated by the Examiner.

It is submitted that only with the use of impermissible hindsight can the present invention be asserted to be unpatentable and even then not all of the features set forth in the claims are specifically disclosed.

C. Claims 18-20 and 23-29 Are Not Obvious

On the merits, claims 18-20 and 23-29 were rejected by the Examiner under §103(a) as being unpatentable over the same four references referred to above when the disclosure of a fifth reference, namely Cherevatsky is added to them. In this

regard, the Cherevatsky patent teaches a specific wall structure for a pressure vessel and does not indicate in any manner that it can be combined with the teachings of any of the other four references, nor be used in a stratospheric vehicle, as called for by claim 18.

Independent claim 18 calls for a stratospheric vehicle having inner and outer spherical shell members separated by an insulating radial gap, the facing surfaces of the inner and outer shell members being coated with a low emissivity material, and the outer shell member having a specific sandwich construction. The sandwich construction of the outer shell member includes a lightweight metal inner skin member, a lightweight composite material outer skin member, and a core member made of a low thermal conduction insulating material.

Claims 19-20 and 23-29 which are dependent from the dependent claim 18 add to its subject matter most of the features set forth above with reference to claims 12 and 14-17.

For the same reasons discussed above in Section B, the Examiner's combination of five references does not disclose, suggest or render obvious the subject matter of claims 18-20 and 23-29. Again, only with the use of impermissible hindsight can the present invention be asserted in any way to be unpatentable. Moreover, even a combination of all five of the references does not disclose all of the features of these claims. Despite the Examiner's assertion that persons of ordinary skill in the art would be "motivated" by the intended use and recognized problems to

be solved to have combined the references in the manner indicated, it is submitted that there is no credible support for that position.

D. Claims 30 and 32-37 Are Not Obvious

On the merits, claim 30 and 32-37 were rejected as being unpatentable under §103(a) for the same reasons as claims 12 and 14-17. In this regard, the Examiner again combined the subject matter of four individual references and where the combination did not directly contain all of the same features argued that there was a "motivation" to combine them and that any differences would have been "obvious" to persons of ordinary skill in the art.

In this regard, independent claim 30 calls for a lightweight fuel tank having inner and outer spherical shell members separated by a radial gap, and two heating mechanisms on the outer shell member, one for controlling the rate of evaporation of material contained in the inner shell member and the other for controlling icing of the fuel tank during use. Dependent claims 32-37 add to the subject matter of independent claim 30 several of the features set forth in the other dependent claims discussed above.

For the same reasons as discussed above, it is submitted that none of the four references cited by the Examiner, whether taken individually or in any permissible combination, disclose or suggest the inventive subject matter of claims 30 and 32-37. There is no support for the Examiner's assertion that persons of ordinary skill in the art would be motivated to combine the references in the manner cited in order to solve the problems faced by the present Applicants. The Applicants' invention provides a

unique and extremely beneficial fuel tank, and stratospheric vehicle which have significant benefit and use in the communication industry. It is only with the use of impermissible hindsight that the inventive fuel tank is asserted to be unpatentable.

IX. Appendix

A copy of each of the claims involved in this appeal, namely claims 12, 14-20, 23-30 and 32-37, is attached hereto as an Appendix.

X. Conclusion

For the reasons advanced above, the Applicant respectfully contends that all of the rejected claims are patentable. Accordingly, the Examiner's final rejection should be reversed and all of the claims should be passed to allowance.

Respectfully submitted,

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Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

APPENDIX

12. A lightweight fuel tank comprising:

an outer spherical shell member;

an inner spherical shell member positioned inside said outer shell member; and

said inner shell member and said outer shell member being positioned to provide an insulating radial gap between them;

a first port member in said outer shell member for evacuation of said radial gap to a vacuum, and to provide access for filling said inner shell member with hydrogen material; and

a first heating mechanism on said outer shell member for controlling the rate of evaporation of material contained in said inner shell member;

said inner shell member having an outer surface and an inner surface, said outer surface being coated with a low emissivity material;

said outer shell member having an outer surface and an inner surface, said inner surface being coated with a low emissivity material.

14. The lightweight fuel tank as set forth in claim 12 comprising a second heating mechanism on said outer surface of said outer shell member for controlling icing of said fuel tank during use.

15. The lightweight fuel tank as set forth in claim 12 wherein said outer shell member is a sandwich construction employing low heat conducting skin and core materials.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

16. The lightweight fuel tank as set forth in claim 12 wherein said low emissivity material is a flash of a copper material.

17. The lightweight fuel tank as set forth in claim 12 further comprising a second port member in said inner shell member for filling said inner shell member with a hydrogen material, said second port member having a valve mechanism.

18. A stratospheric vehicle having a fuel tank, said fuel tank comprising:

an outer spherical shell member;

an inner spherical shell member positioned inside said outer shell member;

said inner shell member and said outer shell member being positioned to provide an insulating radial gap between them;

said inner shell member having an outer surface and an inner surface, said outer surface being coated with a low emissivity material; and

said outer shell member having a sandwich construction with an inner skin member made of a lightweight metal material, an outer skin member made of a lightweight composite material, and a core member made of a low thermal conduction insulating material.

19. The stratospheric vehicle as set forth in claim 18 further comprising a first heating mechanism on said outer shell member for controlling the rate of evaporation of material contained in said inner shell member.

20. The stratospheric vehicle as set forth in claim 19 comprising a second heating mechanism on said outer surface of said outer shell member for controlling icing of said fuel tank during use.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

21. The stratospheric vehicle as set forth in claim 18 wherein said inner skin member is an aluminum material, said outer skin member is a Kevlar material, and said core member is a low density foam material.

22. The stratospheric vehicle as set forth in claim 18 wherein said inner shell member is made of an aluminum material and said outer shell member is made of a sandwich of titanium, Kevlar and Nomex materials.

23. The stratospheric vehicle as set forth in claim 18 wherein said low emissivity material is a flash of a copper material.

24. The stratospheric vehicle as set forth in claim 18 wherein said inner skin member is coated with a low emissivity material.

25. The stratospheric vehicle as set forth in claim 24 wherein said low emissivity material is copper.

26. The stratospheric vehicle as set forth in claim 18 further comprising a first port member in said outer shell member for evacuation of said radial gap to a vacuum, and to provide access for filling said inner shell member with hydrogen material.

27. The stratospheric vehicle as set forth in claim 26 further comprising a second port member in said inner shell member for filling said inner shell member with a hydrogen material, said second port member having a valve mechanism.

28. The stratospheric vehicle as set forth in claim 18 wherein said inner and outer shell members are connected at three locations, namely two opposing equatorial external support positions and a port member.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

29. The stratospheric vehicle as set forth in claim 18 wherein said inner and outer shell members of different materials are connected by a friction welded insert member.

30. A lightweight fuel tank comprising:

an outer spherical shell member;

an inner spherical shell member positioned inside said outer shell member;

said inner shell member and said outer shell member being positioned to provide an insulating radial gap between them;

a first heating mechanism on said outer shell member for controlling the rate of evaporation of material contained in said inner shell member; and

a second heating mechanism on said outer shell member for controlling icing of said fuel tank during use.

32. The lightweight fuel tank as set forth in claim 30 further comprising a port member in said outer shell member for evacuation of said radial gap to a vacuum.

33. The lightweight fuel tank as set forth in claim 30 further comprising a port member in said outer shell member for filling said inner shell member with hydrogen material.

34. The lightweight fuel tank as set forth in claim 30 further comprising a coating of a low emissivity material on the outer surface of said inner shell member.

35. The lightweight fuel tank as set forth in claim 30 further comprising a coating of a low emissivity material on the inner surface of said outer shell member.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]

36. The lightweight fuel tank as set forth in claim 34 wherein said low emissivity material is a flash of a copper material.

37. The lightweight fuel tank as set forth in claim 35 wherein said low emissivity material is a flash of a copper material.

38. The lightweight fuel tank as set forth in claim 30 wherein said outer shell member is a sandwich construction employing a low heat conducting skin and core materials.

39. The lightweight fuel tank as set forth in claim 30 wherein said outer shell member has a sandwich construction with an inner skin member made of a lightweight metal material, an outer skin member made of a lightweight composite material, and a core member made of a low thermal conduction insulation material.

Received from < > at 6/2/03 5:08:26 PM [Eastern Daylight Time]